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“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 11501 (1986): Engine Monoset Pumps for Clear, Cold, Fresh Water for Agricultural Purposes [MED 20: Pumps]

“ज्ञान से एक नये भारत का निर्माण”

Satyanaaranay Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartṛhari—Nītiśatakam

“Knowledge is such a treasure which cannot be stolen”



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Indian Standard

SPECIFICATION FOR ENGINE MONOSET PUMPS FOR CLEAR, COLD, FRESH WATER FOR AGRICULTURAL PURPOSES

1. Scope — Specifies the technical requirements of constant speed, compression ignition (diesel) engine monoset, centrifugal pumps and spark ignition engines for handling clear, cold, fresh water for agricultural purposes.

2. Units; Terminology and Classification — Units, terminology and classification relating to pump shall be as specified in IS : 5120-1977 'Technical requirements for rotodynamic special purpose pumps'.

3. Characteristics of Clear, Cold, Fresh Water — Characteristics of clear, cold, fresh water are specified below:

| | |
|---------------------|-----------------------------------|
| a) Turbidity | 50 ppm (silica scale), <i>Max</i> |
| b) Chloride | 500 ppm, <i>Max</i> |
| c) Total solids | 3 000 ppm, <i>Max</i> |
| d) pH value | 6.5 to 0.5 |
| e) Temperature | (306 K) 33°C, <i>Max</i> |
| f) Specific gravity | 1.004, <i>Max</i> |

Note — If the characteristics of the water differ from those specified in 3 the pump details shall be agreed to between the manufacturer/supplier and the user and shall be specified in the order.

4. Nomenclature Nomenclature of pump parts and diesel engines commonly used shall be as given in IS : 5120-1977, and IS : 11170-1985 'Performance requirements for constant speed compression ignition (engine) for agricultural purposes (up to 20 kW)'. An illustrative set-up of engine monoset pump is given in Fig. 1.

5. Material of Construction

5.1 It is recognized that a number of materials of construction are available to meet the needs for pumps handling clear, cold fresh water. A few typical materials are indicated below merely for the guidance of the manufacturers and the users:

| <i>Sl No.</i> | <i>Material of Construction</i> | <i>Relevant Specification</i> |
|---------------|---|--|
| 1. | All cast iron | Grade FG 200 of IS : 210-1978 'Specification for grey iron castings (third revision)' |
| 2. | Bronze fitted: | |
| | a) Casing | Grade FG 200 of IS : 210-1978 |
| | b) Casing ring, impeller ring, stuffing box bushing, impeller and shaft sleeves (if used) | Grade LTB2 of IS : 318-1981 'Specification for leaded tin bronze ingots and castings (second revision)' |

5.2 Gaskets, Seals and Packings — Gaskets, seals and packings used for clear, cold, fresh water pumps shall conform to those specified in IS : 5120-1977.

6. Direction of Rotation

6.1 The direction of rotation of pumps is designated clockwise or anti-clockwise as observed when looking at the pump shaft from the driving end.

6.2 The direction of rotation shall be clearly marked either by incorporating an arrow on the pump or by a separate metal plate arrow securely fitted to the pump.

**AMENDMENT NO. 3 SEPTEMBER 1999
TO
IS 11501 : 1986 SPECIFICATION FOR ENGINE
MONOSET PUMPS FOR CLEAR, COLD, FRESH WATER
FOR AGRICULTURAL PURPOSES**

(Page 1, Title) — Delete the word 'FRESH'.

[*Page 1, clause 1 (see also Amendment No. 2)*] — Substitute the following for the existing clause:

'1. Scope — Specifies the technical requirements for internal combustion engine monoset centrifugal pumps of flow up to 50 l/s, of self-priming and non self-priming type, for handling clear, cold water for agricultural purposes.'

(Page 1, clause 4) — Substitute the following for the existing clause:

4. Nomenclature — Nomenclature of pump parts commonly used shall be as given in IS 5120 : 1977. An illustrative set up of engine monoset pump of non self-priming and self-priming are given in Fig. 1 and Fig. 3 respectively.'

(Page 2, Fig. 1) --- Substitute the following title for the existing:

ILLUSTRATIVE SET UP OF ENGINE MONOSET PUMP OF NON SELF-PRIMING TYPE

(Page 3, clause 11.1) — Substitute the following for the existing clause:

11.1 Engine Testing — All the tests shall be conducted as per the following applicable standards:

Constant speed, compression ignition engine (up to 20 kW) IS 11170 : 1985

Spark ignition engines IS 7347 : 1974'

(Page 3, clause 11.3.1) — Insert the following at the end of the clause:

"Pumps of self-priming type shall also be tested to determine the priming time as per the procedure given in IS 8418 : 1999 'Pump — Centrifugal — Self-priming'."

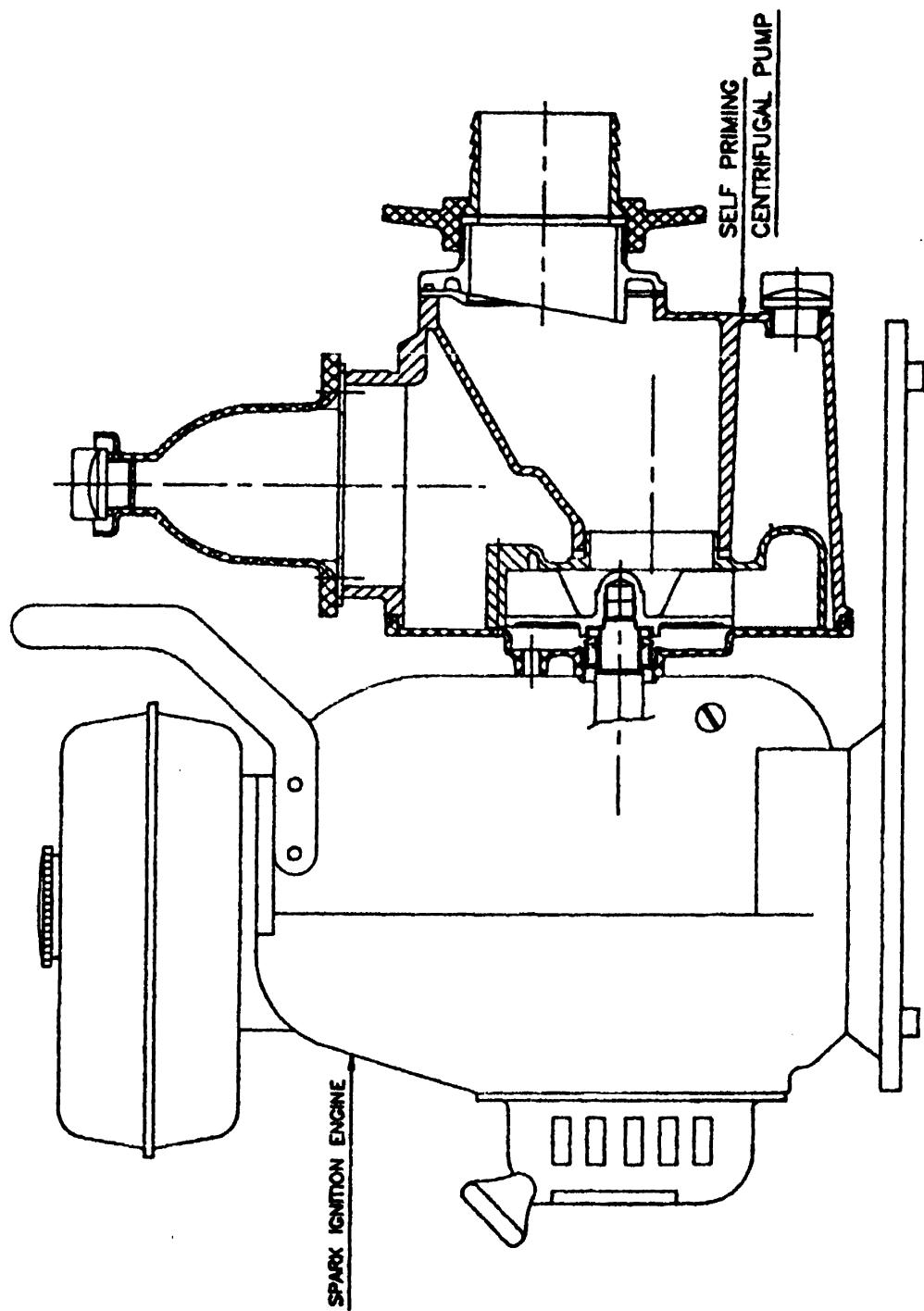


FIG. 3 ILLUSTRATIVE SET UP OF ENGINE MONOSET PUMPS OF SELF-PRIMING TYPE

(Page 3, clause 11.3.2, line 1) — Substitute 'fuel' for 'diesel'.

(Page 3, clause 11.4) — Substitute the following for the existing clause:

'11.4 For non self-priming type pump of specified duty head and discharge rate, fuel consumption shall not exceed the following.

11.4.1 For compression ignition engine monosets (diesel engines)

| | |
|--|---|
| 1) For engine speeds 1 000 to 2 000 rpm | Values indicated in Fig. 2 |
| 2) For engine speeds 2 001 to 3 600 rpm | 1.22 times the values indicated in Fig. 2' |

(Page 3, clause 11.4, Example 2) — Insert the following clauses 11.4.2 and 11.5 at the end of Example 2:

'11.4.2 For spark ignition engine monosets (petrol and/or kerosene engines):

Fuel consumption for specified duty head and discharge rate for monoset ratings 1 kW to 6 kW and speeds 900 rpm and above shall not exceed the values specified in Fig. 4 multiplied by factors given below for various types of engines:

| <i>Engine</i> | <i>Multiplying Factor</i> |
|---------------------------------------|--|
| 1) Four stroke side valve engine: | |
| a) Kerosene run | Values indicated in Fig. 4 |
| b) Petrol run | 0.8 times the values indicated in Fig. 4 |
| 2) Four stroke overhead valve engine: | |
| a) Kerosene run | 0.8 times the values indicated in Fig. 4 |
| b) Petrol run | 0.63 times the values indicated in Fig. 4 |

11.5 The fuel consumption for engine monoset of self-priming type pump shall not exceed the values specified for engine monoset of non self-priming type pump specified in 11.4 multiplied by 1.2 for various types of engines.

Amend No. 3 to IS 11501 : 1986

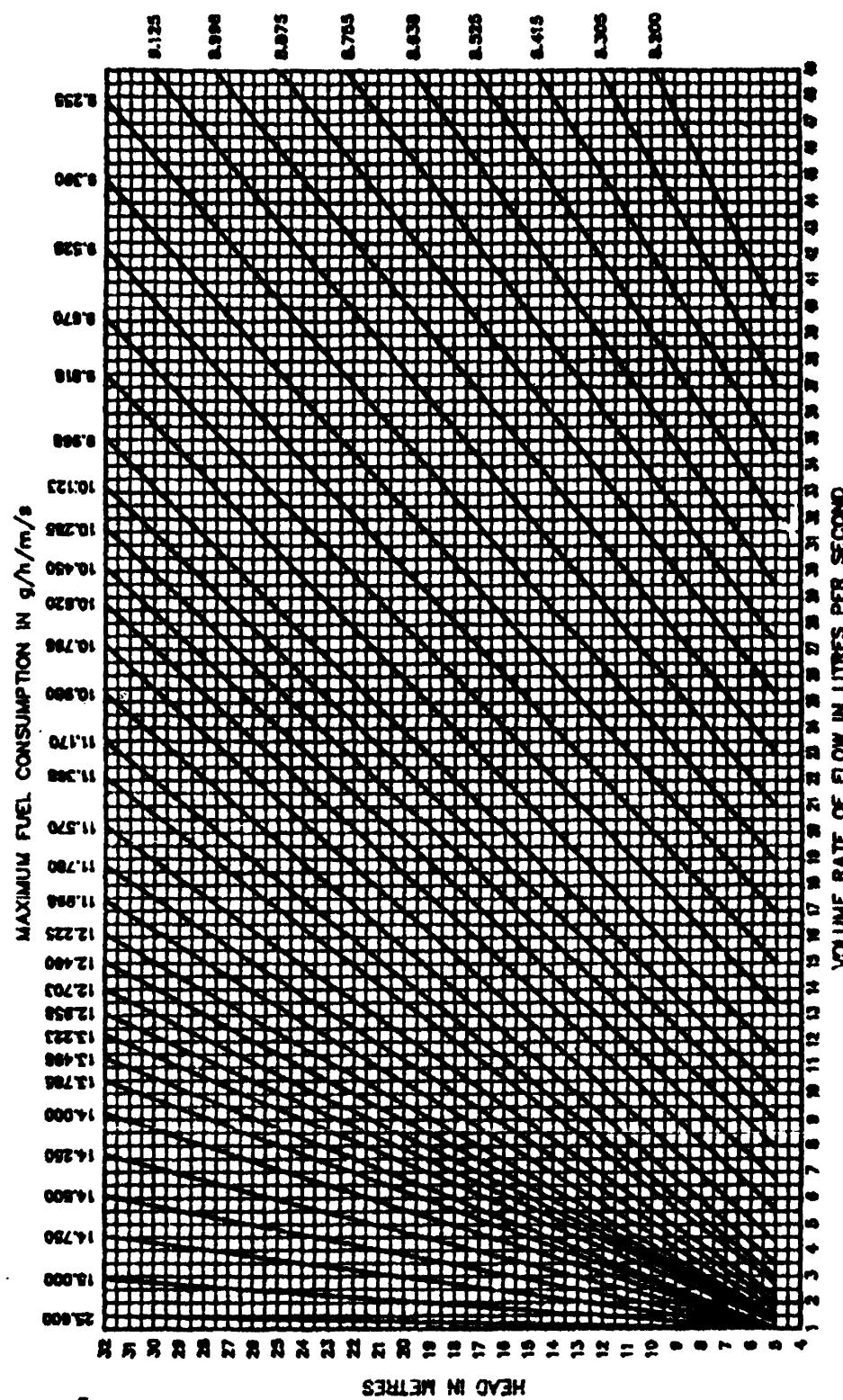


FIG. 4 MAXIMUM FUEL CONSUMPTION FOR VARIOUS DUTIES

(HMD 20)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 AUGUST 1989

TO

IS: 11501-1986 SPECIFICATION FOR ENGINE
MONOSET PUMPS FOR CLEAR, COLD, FRESH
WATER FOR AGRICULTURAL PURPOSES

(Page 1, clause 1, second line) - Insert
'of flow up to 50 l/s' after 'centrifugal
pumps'.

[Page 1, clause 3(d)] - Substitute '6.5 to
8.5' for '6.5 to 0.5'.

[Page 2, clause 9.1(b)] - Substitute
'Manometric suction lift' for 'total suction
lift' and '33°C' for '30°C'.

(EDC 35)

Reprography Unit, BIS, New Delhi, India

10.3 Impeller — The impeller shall be properly balanced along with any other unmachined rotating parts on proper balancing equipment.

Note — 'Balancing means the balancing of manufacturing defects in the impellers and not balancing of axial hydraulic thrust in the impeller.'

10.4 Shaft — The shaft shall be of sufficient size to transmit the required power.

11. Testing

11.1 Engine Testing — All the test shall be conducted in accordance with IS : 11170-1985.

11.2 The various measurements and checking of measuring instrument for total head and discharge rate shall be done as laid down in IS : 11346-1985 'Testing set up for centrifugal pumps'.

11.3 Pump Testing

11.3.1 Testing shall be conducted in accordance with IS : 11346-1985 for total head and discharge rate measurement at different heads.

11.3.2 Fuel consumption — For each observation, time for 50 cc of diesel consumption shall be recorded and then fuel consumption in g/h to be computed. A typical sheet for all the observations and calculation is given in Appendix A.

11.3.3 Following affinity laws shall be applied to derived the performance at specified speed:

$$Q \propto n$$

$$H \propto n^2$$

$$\text{Fuel consumption} \propto n^3$$

Where Q is discharge, H is head and n stands for RPM.

11.4 Fuel consumption for specified total head and discharge rate shall not exceed the value indicated in Fig. 2. For engine speed between 1 000 to 2 000 rev/min, maximum fuel consumption figures shall be as given in chart. For engine speed above 2 000 rev/min maximum fuel consumption figures shall be 1.22 time of that given in chart.

Example 1 :

For specified duty say total head 12 m, discharge rate 24 l/s, and

Speed 1 500 rev/min

From Fig. 2 maximum fuel consumption at this duty point = 3.756 g/h/m/l/s

As speed is within the limit of 1 000 to 2 000 rev/min, the value as per chart is to be used. Therefore, maximum fuel consumption at duty point allowable

$$= 3.756 \times 12 \times 24 \text{ g/h}$$

$$= 1081.73 \text{ g/h}$$

Example 2 :

For specified duty say total head 9.5 m, discharge rate = 26 l/s, and

Speed 2 500 rev/min

From Fig. 2 maximum fuel consumption at this duty point = 3.650 g/h/m/l/s

But, as speed is above 2 000 rev/min, the above fuel consumption figure is to be multiplied by 1.22. Hence, maximum fuel consumption = $1.22 \times 3.650 \text{ g/h/m/l/s}$

$$= 4.453 \text{ g/h/m/l/s}$$

Therefore, maximum fuel consumption at duty point allowable

$$= 4.454 \times 9.5 \times 26 \text{ g/h}$$

$$= 1099.89 \text{ g/h}$$

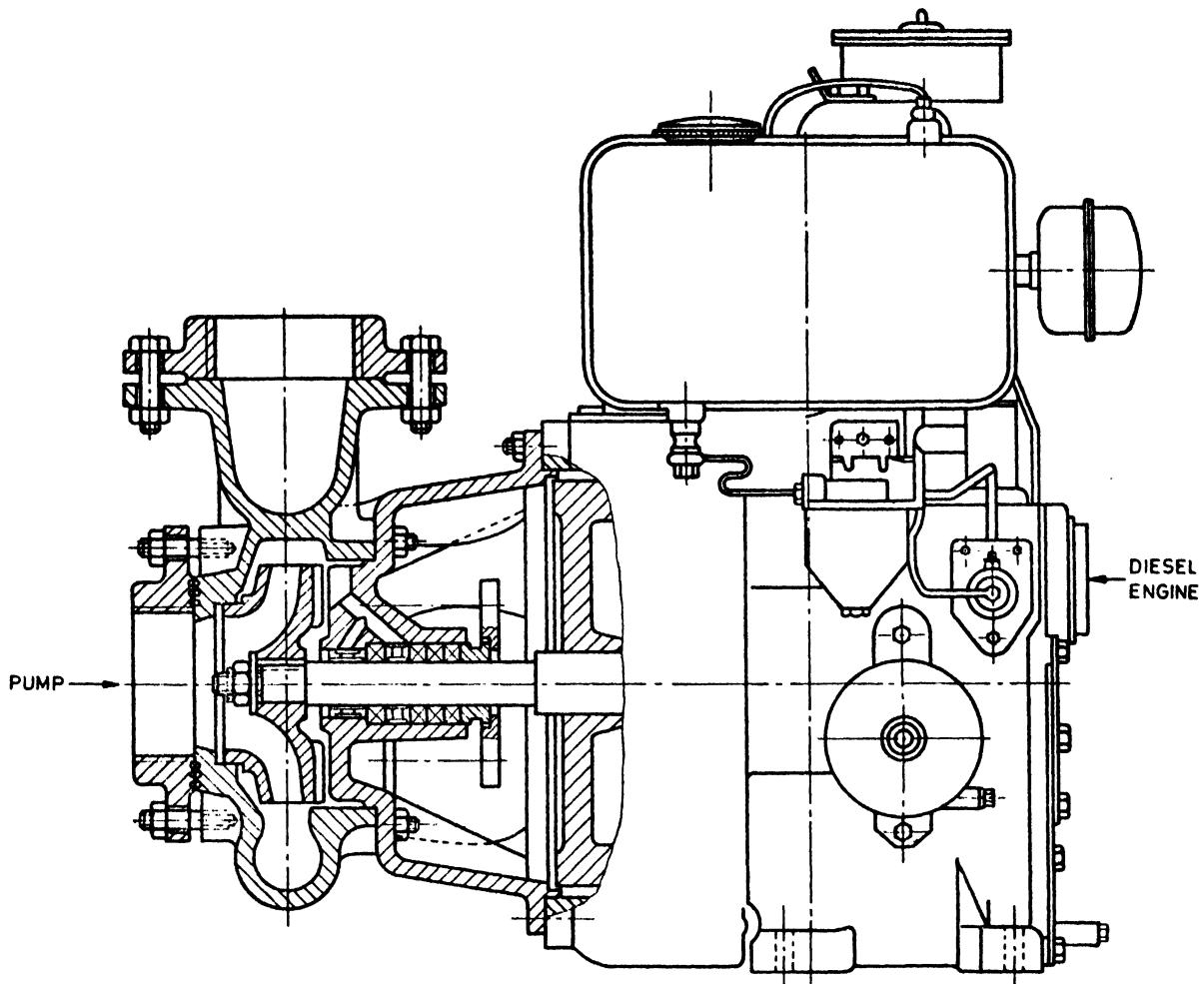


FIG. 1 ILLUSTRATIVE SET UP OF ENGINE MONOSET PUMP

7. Suction Limitations — Suction limitations affecting the performance of pumps for clear, cold, fresh water shall conform to those specified in IS : 5120-1977.

8. Factors Affecting Pump Performance — Factors affecting pump performance shall conform to those specified in IS : 5120-1977.

9. Design Features

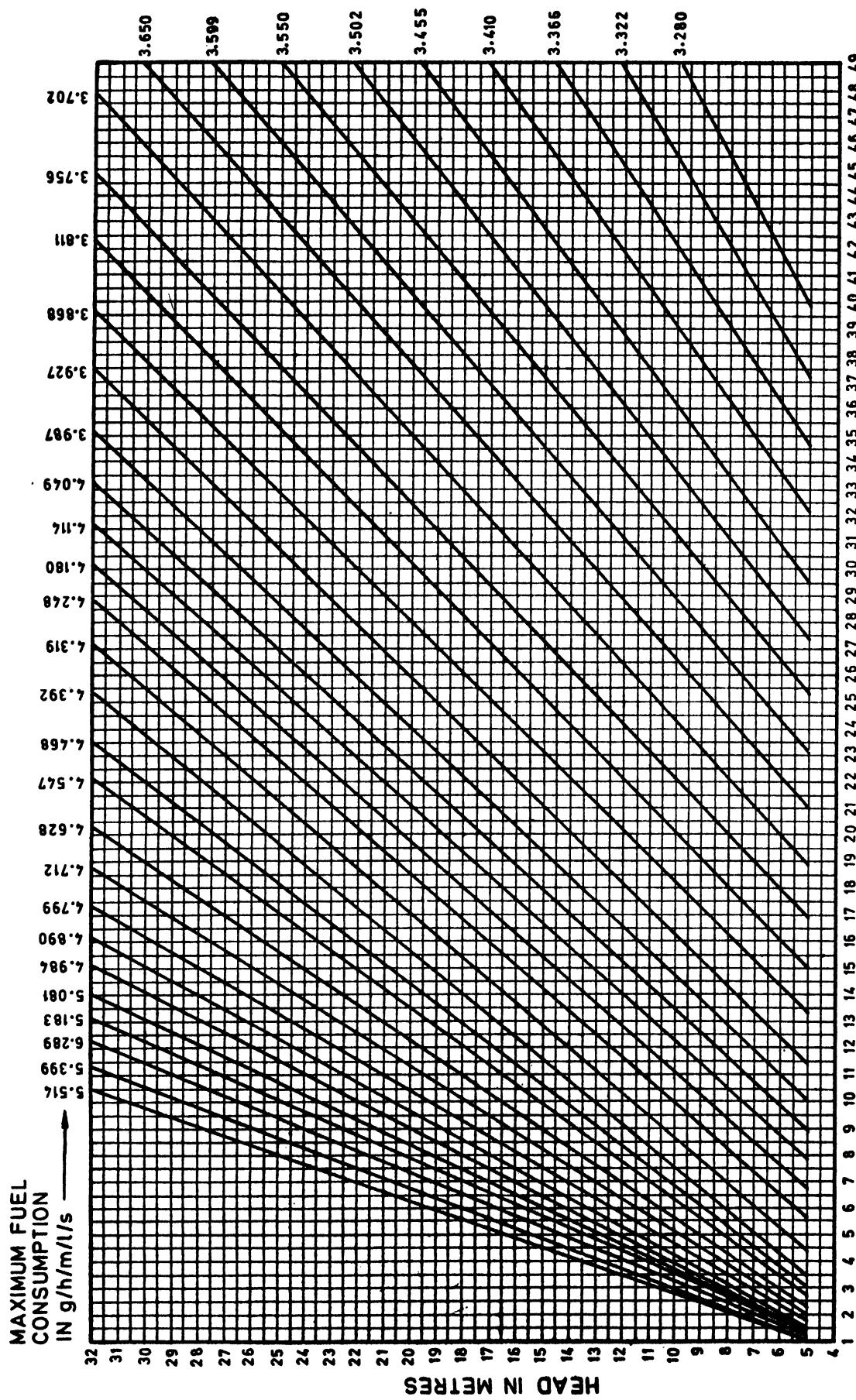
9.1 The pump and engine elements of the set shall have suitable features properly designed to ensure satisfactory performance. In particular, the design features, such as the following shall be incorporated:

- a) The engine shall not get overloaded in entire working range of pump capacity.
- b) The pump shall be capable of working under a total suction lift of 6 metres for speeds up to 1 800 rev/min and 5.9 metres at higher speeds unless otherwise specified, at mean sea level and water temperature of 30°C.
- c) Suction lift under (b) above is to be reduced for higher altitudes at the rate of 1.15 metres for every 1 000 metres above mean sea level. The temperature correction shall be obtained from steam tables.

10. General Requirements

10.1 The general requirements for the pump shall be as given in IS : 5120-1977.

10.2 Casing — Casing shall be of robust construction and tested to withstand 1.5 times the maximum discharge pressure.



VOLUME RATE OF FLOW IN LITRES PER SECOND
FIG. 2 MAXIMUM FUEL CONSUMPTION FOR VARIOUS DUTIES

AMENDMENT NO. 1 SEPTEMBER 1987

TO

**IS:11501-1986 SPECIFICATION FOR ENGINE MONOSET
PUMPS FOR CLEAR, COLD, FRESH WATER FOR
AGRICULTURAL PURPOSES**

(Page 5, clause 14) - Add the following new
clause after 14:

'14.1 Certification Marking - Details available
with the Bureau of Indian Standards.'

(EDC 35)

Reprography Unit, BIS, New Delhi, India

12. Sampling

12.1 The Scale of Sampling and Criteria for Conformity — shall conform to IS : 10572-1983 'Methods of sampling pumps'.

13. The Information to be Supplied by the Purchaser and the Supplier — The information to be supplied by the purchaser and the supplier shall be the same as that specified in IS : 5120-1977 and IS : 11170-1985.

14. Marking — The monoset shall be clearly marked with the following:

- a) Manufacturers name or trade-mark (if any),
- b) Serial number,
- c) Engine rating and speed,
- d) Size,
- e) Total head,
- f) Capacity,
- g) Fuel consumption in g/h,
- h) Maximum power consumption,
- j) Head range, and
- k) Capacity range.

15. Guarantees and Tolerances on Pump Performance

15.1 Guarantee of Workmanship and Material — The pumps shall be guaranteed by the manufacturer against defects in material and workmanship, under normal use and service, for a period of at least 15 months from the date of despatch or 12 months from the date of commissioning whichever is less.

15.2 Guarantee of Performance — The pumpset shall be guaranteed for its performance of the rate of flow and total head at the specified point. The fuel consumption of the engines shall be guaranteed at the specified duty point only. The fuel consumption at the specified duty point shall not exceed 1.1 times of the declared value.

15.2.1 The tolerances allowed on volume rate of flow and total head shall be in accordance with IS : 11346-1985.

15.2.2 Guarantees for mass-produced pumps — For mass-produced pumps, any pump corresponding to the curves give for any chosen operation point, results not divergent from the values of the published curve by more than:

- a) —6 percent for total head,
- b) —8 percent for rate of flow, and
- c) +10 percent for power input.

E X P L A N A T O R Y N O T E

As for agricultural purposes diesel monoset are generally used, the Committee felt the need of preparing separate standard engine monoset pumps. Diesel engine monoset pumps are centrifugal pumps of single suction with driving diesel engine designed and built as complete unit on one shaft (that is the crank shaft and the pump shaft are one and same). This eliminates pump shaft, pump bearing and make the combined unit simple and compact. The requirement of monoset centrifugal pumps fixed with electric motors are covered in IS : 9079-1979 'Specification for monoset pumps for clear, cold, fresh water for agricultural purposes'.

APPENDIX A

(Clause 11.3.2)

PUMP TEST RECORD SHEET

| | | | | |
|---|--------------|-------------|----|--------------|
| Pump Type | Pump No. | Engine Make | kW | Engine Frame |
| Suction mm | Delivery mm | | | |
| Impeller Dia mm | mm. Material | | | |
| Capacity measured by 90° V-notch/volumetric tank (litres) Full Load rpm | | | | |

Suction lift measured by : Hg manometer/Vacuum gauge

Delivery head measured by : Hg manometer/Pressure gauge.

| Sl No. | Speed of Pump rev/min | Suction Gauge Reading | Delivery Gauge Reading | Gauge Distance | Velocity Head Correction | Total Head Over Notch | Discharge in l/s | Time for 50 cc Fuel Consumption | Fuel Consumption g/h | Performance Converted at Specified Speed | | |
|--------|-----------------------|-----------------------|------------------------|----------------|--------------------------|-----------------------|------------------|---------------------------------|----------------------|--|-------|----------------------|
| | | m | m | m | m | m | l/s | g/h | kg/h | H m | O l/s | Fuel consumption g/h |
| | | | | | | | | | | | | |

Pump certified for

- Total head in m.
- Discharge in l/s rev/min
- Fuel consumption in g/h

Date

Set started at

Tested by
Set stopped at

General requirements — Satisfactory/unsatisfactory

Remarks